

Nomadic Currents a Handicap in Efforts to Make Sea Highways Safer for Man

Changes in Atmospheric Pressure Affect Courses of These Rivers of the Ocean—Remarkable Instruments and a Floating Hydrographic Office Are Among Recent Safeguards Against Floating Ice.

WHEN Captain P. C. Johnson, inspector of lighthouses for the Dominion government, returned with the steamer Montezuma a short while ago after searching for the Titanic's dead, he referred to the fact that he had discovered the existence of a pocket of cold water right in the normal path of the Gulf Stream. This was not the only curious aspect of the treacherous Arctic current—the flow of that unusual body of cold water was of a velocity far below the sweep of the Gulf Stream, into whose path it had wandered. Captain Johnson reported the Labrador current to have thus invaded southward the normal course of the Gulf Stream for a distance of quite one hundred miles. All of which goes to show that there are forces at work in directing the great ocean rivers sufficiently powerful to disturb the courses of these streams and to create conditions which demand the utmost vigilance on the part of navigators.

Our own naval authorities were alive to the hazards to which ocean traffic upon the North Atlantic was exposed, and, because of this appreciation of the unusual state of the conflicting currents, the scout cruiser Birmingham was dispatched on May 19 to patrol that area of the Atlantic which covers the southern apex of the downward drift of icebergs within the neighborhood of the present steamer lanes. Thanks to the services of the Birmingham and her relief, the scout cruiser Chester, the fast passenger traffic on the North Atlantic has been materially safeguarded from harm. But the mission of these ships has been something more than keeping watch for ice and in relaying by wireless to Halifax, both night and day, the results of their own observations and the reports received from other ships by radio-telegraphy.

When the Chester lately took station upon the patrol area she carried with her three officials of the United States Bureau of Standards. These officials went to supervise the employment of certain sensitive instruments which were taken along for the purpose of observing the temperatures and the density of the sea water throughout the patrol field. The object of the investigation was to supplement the data already in the hands of the United States Hydrographic Office bearing upon the mutual relations of the waters of the Labrador current and the Gulf Stream.

PUZZLING SEA CONDITIONS.

A good deal of conflicting information was received shortly after the loss of the Titanic relating to the value of temperature tests for the purpose of detecting the approach of ice and the actual position of the observing ship, basing her geographical location by her course in the Gulf Stream or the Arctic current, as the case might be. When ships are running in a fog and astronomical observations are impossible, the temperature of the water, the depth of the water, if the ship be within soundings, and the character of the bottom all serve to help the seafarer "feel" his way when other guides fail. In a measure, it is as if any of us tried to follow the thread of a winding road where the sidewalk differed from the middle of the track only in the hardness of the treadway. If the ground became soft, we should know that we were not in the path, and if the dirt in the

CAUSE OF THE GULF STREAM.

The scientists are not yet agreed upon the prime promoting cause for the Gulf Stream and the other great ocean currents, but there is much to justify the belief that atmospheric pressure is mainly responsible. This may sound quite impossible to the layman at large, and his wonderment is but another evidence of how little most of us appreciate the natural forces that are continually at work everywhere about us. When the barometer falls, indicating a lowering of atmospheric pressure, then it is that the outlying air starts moving toward the area of lower pressure, and this impulse may result in either a wind or a gale, while the actual difference of pressure is less than half an inch by the barometer.

Now, the waters of the ocean are, in their turn, affected by this changing weight, as it were, of the superposed air. An area of high pressure, like a plunger pressing down upon the surface of a confined body of water, tends to make the sea flow away toward the "low" areas. In the middle of the Atlantic there is normally a constant

area of high pressure, and this probably drives the waters forming the Gulf Stream westward and into the confines of the Gulf of Mexico, and thence northward through the channel we know of the southeastern coast of Florida. The trade winds increase this movement. The height of the Gulf Stream's surface above Cape Florida is several feet above the surface of the cur-

rent where it passes seaward in the latitude of Sandy Hook, and this gives us some idea of the downhill course of this great ocean river which keeps it moving steadily on toward the north.

If atmospheric conditions, to which our bodies are seemingly insensitive, so far as our consciousness goes, can control the movement of a body of water flowing with an hourly volume of 90,000,000,000 tons, then the atmosphere, when disturbed, can also deter the onward sweep of one ocean river while stimulating that of a rival current. The fact that Captain Johnson, of the Dominion's service, found the Labrador current trespassing forcibly across the normal path of the Gulf Stream, reaching a hundred miles further south than usual, would seem to indicate that Nature's balance had been destroyed by some conditions which may have lowered the commonly prevailing area of high pressure in the mid-Atlantic. The barrier of warm water against the northern flood was strangely weakened through some cause, and the cold Arctic flood, bearing in its frigid grip Greenland's icy offspring, swept southward upon an unwanted course, keeping those great frozen bodies intact just that much longer.

Will the recent disaster and the researches of scientific investigators suggest some reliable means for detecting the neighborhood of ice when it cannot be seen because of thick or foggy weather? Will the navigator have at his disposition heretofore instruments of some sort which will keep him warned despite the fields and insidious flow of the two great battling currents where they fight it out for supremacy southeast of Newfoundland? Already a number of ingenious minds have been giving careful consideration to the problem, but it is quite likely that the best of these inventions can do nothing more than supplement human vigilance—they cannot supplant unflinching watchfulness during night time and the hours when fog or haze narrows the field of vision.

Professor H. T. Barnes, of McGill University, Montreal, has constructed an instrument which he calls a microthermometer, and it is said that the apparatus consists primarily of a delicate electrical means of recording the flow of a current when passing through a wire differing in its resistance to that flow with varying degrees of heat or cold. When one end of the circuit is exposed to the sea water the conducting wire for the electricity becomes relatively a good or bad medium for the transmission of electric current, and upon this index of rise or fall of sea water temperature Professor Barnes depends to warn him of the proximity of ice. Un-

fortunately, the ice will not always noticeably lower the temperature of surrounding water if that water be already cold, and even if the adjacent current be comparatively warm a navigator will not be warned if approaching the ice with the current, but he may be helped if nearing the ice from leeward and when running against the water which has been chilled by contact with a berg or a floe.

These circumstances must be borne in mind if we are to give any value to this automatic means of detecting changes of temperature in the ocean. These alterations, too, may not be very pronounced, and it is for this reason that readings by the thermometers ordinarily employed on shipboard and handled roughly as they are are not always to be relied upon. It is a common practice on many ships to keep an eye on the thermometer in the engine room which registers the temperature of the sea water drawn inboard to feed the condensers. At first blush this might seem to be a pretty reliable check upon changes, but it really is not, because this water passes through metal conduits that are affected by the surrounding atmosphere in that part of the ship.

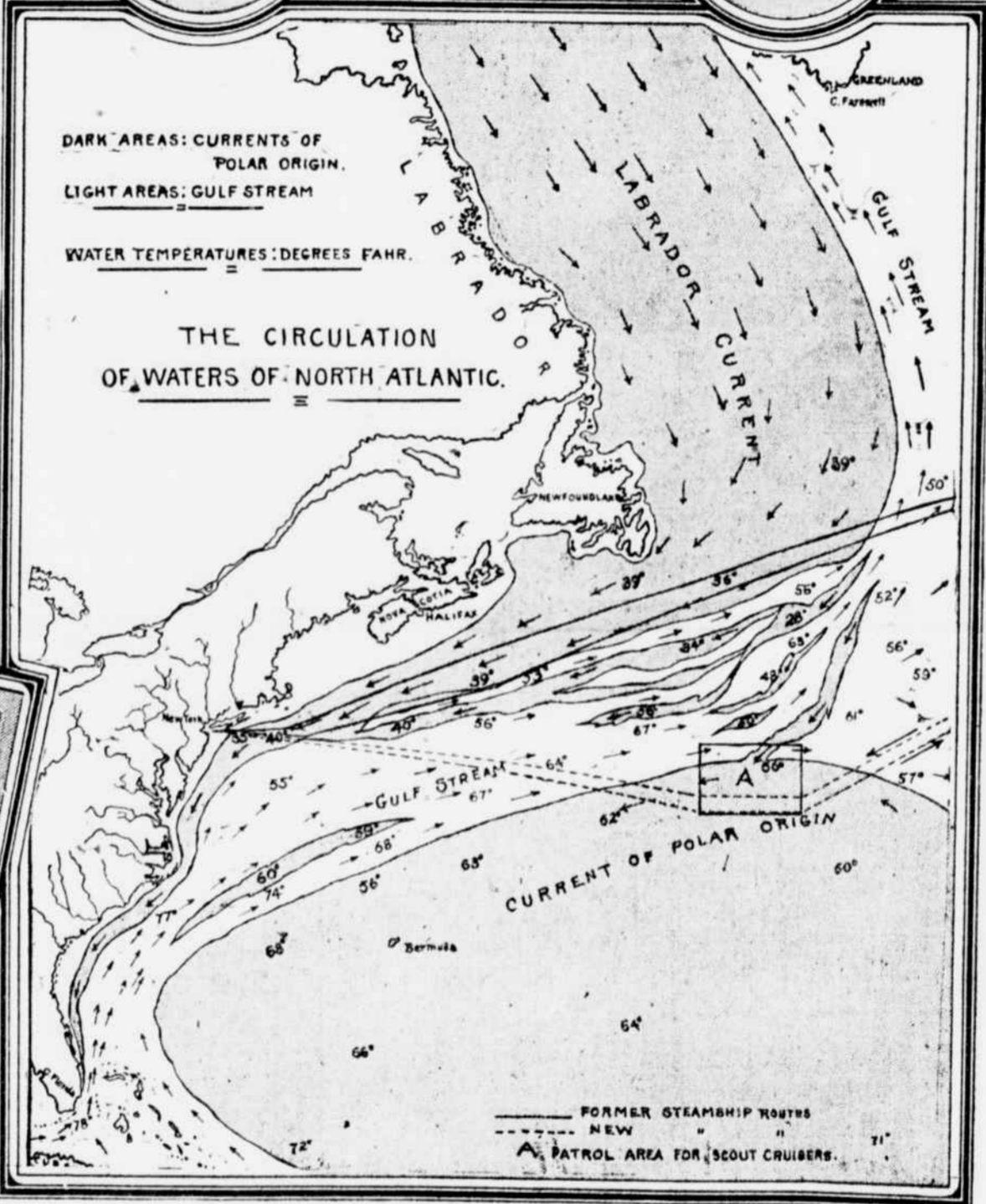
This may make a difference of several degrees in the readings of the thermometer, and the safety of the craft depends upon the length of the interval between the warning and the reaching of the menacing ice. Naturally, the further a craft is from the berg the less the water will show its influence, and the faster the ship is running the more necessary is extreme sensitivity on the part of the instrument employed in helping the navigator. The thermometric warning apparatus should be particularly responsive to sudden variations of the sea water's temperature no matter how small or slight these drops or rises may be. This brings us to another and exceedingly ingenious device designed to meet these particular requirements.

William H. Bristol, who has developed a large number of widely used recording thermometers, is the inventor of the instrument in question. Mr. Bristol relies upon the phenomena characteristic of the working of a thermo-electric couple, and the point 3 connects the elements of the couple where the two metals are to be acted upon by changes of temperature. The strange thing is that when the loop at 3 is suddenly raised or lowered ever so little in its temperature, compared with the ends at 4, 4, an electro-motive force is generated without any other means, or



A Consultation of the Nautical Experts at the Local Branch Hydrographic Office.

Types of Apparatus by Which Samples of Seawater Can be Brought Up from the Depths for the Purpose of Determining the Degrees of Salinity.



DARK AREAS: CURRENTS OF POLAR ORIGIN.

LIGHT AREAS: GULF STREAM

WATER TEMPERATURES: DEGREES FAHR.

THE CIRCULATION OF WATERS OF NORTH ATLANTIC.

FORMER STEAMSHIP ROUTES

PATROL AREA FOR SCOUT CRUISERS.

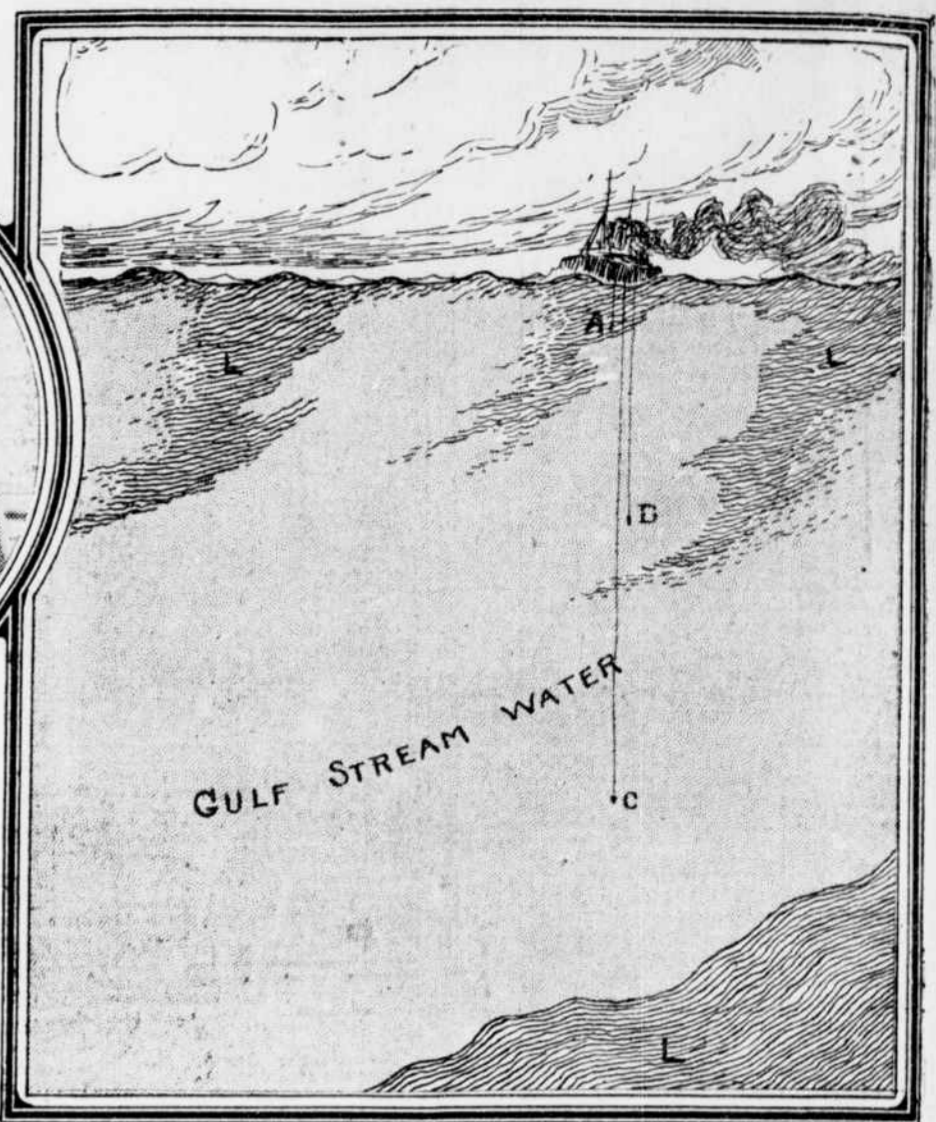


Diagram Showing How the Waters of the Two Currents May Mix. Common Conditions Which Puzzle the Navigator. A.—TAKING TEMPERATURE NEAR SURFACE (COLDER). B.—DEEPER (WARMER). C.—COLDER WATER OF LABRADOR CURRENT. D.—NORMAL AND STILL WARMER WATER OF GULF STREAM.

slights, six feet apart, on the foremast. Some weeks ago the steamship Oceanic came near running down the Birmingham, which was lying to, because at a distance the two red lights merged into one, and the White Star liner thought the ship ahead was under way and passing to port. There were some anxious moments aboard both vessels, but a mishap was avoided through the alertness of the lookouts. Thus the very means taken to protect the cruiser in her special service came near inviting a disaster. This happened upon a clear night, and we must not forget that the Birmingham and the Chester are alternating on this duty in all kinds of weather and right within the lanes of the fastest of our trans-Atlantic liners.

Even with our cruisers covering the patrol area and reporting the absence of ice or other menaces to navigation, still this is not an unalarming index that all is safe. On June 1 the Birmingham reported information received from twenty-six steamers, "no ice or derelicts seen." On the same date a ship to the northward bound for Boston suddenly found herself unpleasantly near four very large icebergs when the fog lifted. Again, while the Chester was on duty and reported "no ice" another ship encountered a great deal of ice and saw many icebergs when working along to the southward of Newfoundland. This merely goes to show that the dangers in one part of the Atlantic may become in the course of a few days menaces in other parts then free, and it becomes necessary for every merchant craft to keep the scouts posted as far as possible in order that they may become dispatching stations for the fullest maritime information relating to the outlying conditions of the sea.

In effect, the United States government has established a floating hydrographic office in the mid-Atlantic, and it will take some time before the general public realizes the splendid initiative which has been shown by us for the benefit of the shipping of all nations in waters far beyond the limits of national territorial jurisdiction. In order to take advantage of the work of our cruisers, the Navy Department has instituted at the local branch of the Hydrographic Office a day and night service, so that reports relayed at all hours from the scouts to Halifax and thence dispatched to New York can be disseminated to the maritime world with the least delay. In this manner our nautical guides are ever awake, and the people directly profiting most by this expensive system of surveillance and information are foreign ship owners. As one bluff skipper of a big English liner expressed it: "You Yankees are a lot of spendthrift fools; you are keeping up a costly outfit for the sake of other flags; your own shipping so helped isn't a drop in the bucket compared with the tonnage of foreign craft."

That outspoken Britisher told only half of the truth; we are trying to safeguard our people and our approaching citizens of tomorrow because we have had our faith badly shaken in the skill and care of the navigators from the other side of the Atlantic. But quite apart from this, we have realized that modern conditions have suddenly emphasized the need of new means to help the seafarer upon his hazardous journey from shore to shore, and, too, it has become apparent that a more intimate study of the Gulf Stream and the action of the Labrador current are necessary.

Wireless telegraphy has furnished one vital instrument in promoting the widening of our knowledge of these ocean rivers, and it is quite likely that we shall learn fully as much by carefully studying atmospheric conditions at the same time. None of us is likely to begrudge the dollars spent in this way if data are garnered which will prove not only of value in aiding the seafarer but also of value in aiding the movement of storms which otherwise might sweep unheeded and disastrously down upon our own coasts. The mission of the Birmingham and the Chester may lead to truly remarkable developments. They may prove to be the keys that shall open to us a field of knowledge hitherto but dimly understood.

The hydrographers have known for some years that there is a region in the North Atlantic covering an area of more than nine million square miles where the barometric pressure is above the normal, and that north of this immense zone there is an area of ocean surface of approximately 250,000 square miles where the pressure is below the normal. When these areas are thus opposed and their proportions remain constant, it is quite likely that the Gulf Stream has a more northern and a more vigorous sweep where it meets the Labrador current to the south and east of Newfoundland. But we do not know positively what may be the mutual effects upon these great opposing currents of the sea if nature upsets the poles or balance of these immense areas of antipathetic "high" and "low" barometric pressures. Off there in the wilderness of the ocean waste the sun may be working invisible changes of which we know naught, and only when that influence, like the far-reaching ripple rings of a stone dropped in the water, shows in some material manner do we appreciate what the magnitude of these shifting weights of the atmosphere may do toward working physical revolutions and in adding to the difficulties of even modern man's ventures upon the sea.

A Sail to the Canaries

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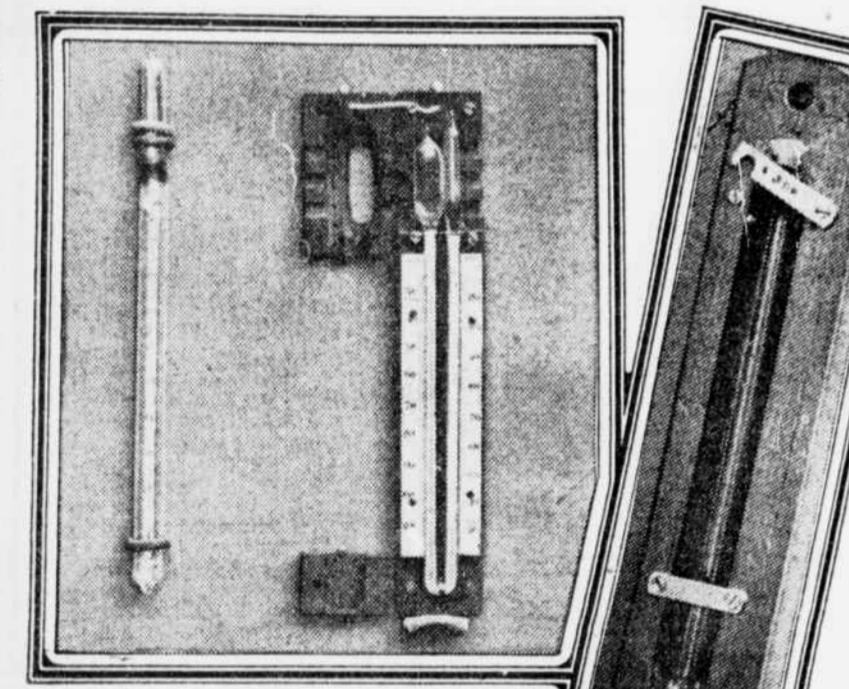
the lava slopes were vineyards, but otherwise no green relieved the wastes of cinders except an occasional cactus thicker or a row of aloes. Many of these plants were in bloom, the slender stalk which bore the yellow blossom rising six to eight or nine feet into the air. But there was nothing that offered a square inch of shade as we topped the rim of the cauldron. When the rim had been surmounted a strange sight met our gaze—at least, it was strange to me. We were on the edge of a vast, black bowl, a mile wide at the top, 500 feet deep and half a mile wide to the bottom. The floor of the crater was level, and not quite in the center rose the white stucco walls of a farmhouse, surmounted by a sloping roof of red tiles! It was almost the lion and the lamb. Fields of yellow grain surrounded the house, and here and there rows of grape vines hung to the steep, sloping walls. The track doubled and redoubled on itself, but down it our tiny donkeys carried us in safety. At the farm we were rewarded with a drink of clear spring water, a draught only thoroughly to be appreciated after one has lived for three weeks on goat's milk and wine preceded by three weeks of ship's water. The farmer told us that the soil in the crater was so productive it was possible to obtain three crops a year. We thought he deserved them.

By noon on the following day the last of the unloading for Grand Canary was accomplished, and as we had a few thousand cases of oil for the island of Tenerife the captain went ashore to clear for Santa Cruz. On his return our disreputable friend, the tug, passed a line aboard and started to swing us around from the quay, where we had been lying with the head pointed shoreward. Whether the tug captain was in too great a hurry to have the job over with, or whether he had underestimated the overhang of the schooner at the stern, I do not know, but whatever the reason, he started off too sharp an angle. Suddenly there came a bump, then a loud crash. The ship's overhang had raked the quay, and a lamp post, which had stood in its path, had gone by the board. This the tug captain perceived, it was enough. Regardless of damage done, or likely to be done, to the Jordan, he instantly cast off, leaving us with the stern hard and fast on the granite seawall and the bow swinging with the tide, which

was running out, thus driving the stern further on the quay. When we had come into port our skipper had experienced considerable difficulty in making the tug's master understand his English. But this time his language was simple and forceful enough for a babe of a Hotentot to understand. But all to no purpose—the "Yankee captain" would have to go ashore and pay for the lamp post before the tug would pick up our line again.

"Get me the stern of my boat off," roared our commander. "Do you want me to smash my rudder?" "I don't know the Spanish for 'nothing doing,'" but that was the tug's reply. Whether we lost our rudder or the ship was nothing to them. One would have thought the lamp post had been a sacred shrine, it was so important.

There was nothing for it, however, but for the captain to hurry ashore and pay the dockmaster for the post and lamp—\$750 being fully \$7 more than they were worth. But we could get away (so we thought), and the right and wrong of the matter could be thrashed out by the owners. We reckoned, however, without sufficient knowledge of the Spanish mind. It was now past sunset and no sailing ship might leave port after sunset. In vain we argued that the job had been undertaken while the sun was still above the horizon and the sun was still above the horizon and that if the sun chose to set in the mean time it was no affair of ours or of the tug's. In vain. And the upshot was that we had to drop the bow anchors to keep her steady at the head and put over a kedgie anchor abeam of the stern and haul the vessel over to it. A few hours later, as smiling as the new risen sun, the tug captain condescended to haul us out. With a fair breeze we made Santa Cruz before nightfall and dropped anchor in the roadstead. On the quay they showed us where the bullet that had taken off Admiral Nelson's arm in the battle of Trafalgar had fallen. They showed us the stone-work of course, they believed that they had identified the spot. They sundry dozens of beggars and self-appointed "guides" promised on the morrow to show us the flags that had been taken from the English fighter (whose only defeat was that of Santa Cruz Bay) and the wonderful valley of Orataiva and the camels hauling sand for ballast, and—but, as Kipling would say, all that is "another story."

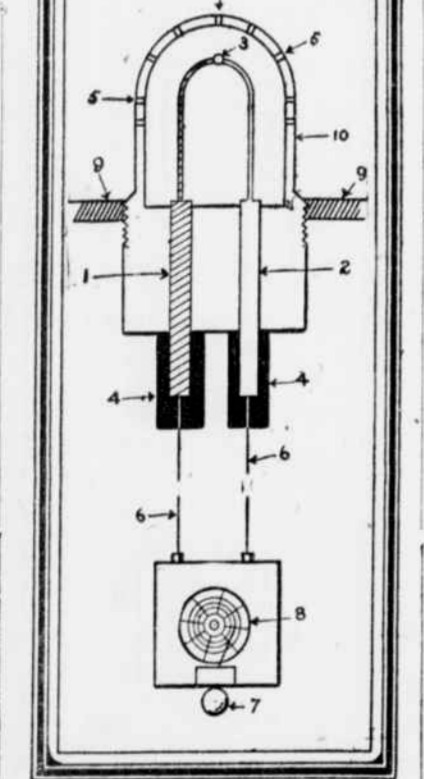


Deep-Sea Thermometers Showing the Encased Instruments Opened and Closed as Well as the Recording Tubes Employed in Taking the Ranges of Heat of the Gulf Stream.

wagon track were of one kind and that on the sidewalk were another sort, our feet would be conscious of the difference. But we should certainly become confused if some unusual circumstance deranged the state of the road, and the sidewalk and the wagonway became identical so far as our feet could tell us.

The confusing reports of captains of vessels can be explained naturally if we bear in mind that the Gulf Stream is a body of warm water highly impregnated with salt, while the Arctic or Labrador current is much colder and at the same time far less saline. But for its warmth, which causes it to rise even with its load of salt, the water of the Gulf Stream is actually much denser and heavier than the waters from the north, when both are reduced to a common temperature. In other words, there is a very nice balance of the normal relations of the two contending currents and it takes relatively little to disturb this condition.

When we went to school and studied physics, we can all recall how graphically we were shown that colored warm water would float, with a sharp line of demarcation, on top of colder water held in a glass goblet; and this fixed it in our minds that warm water was lighter than cold water. The sea captain has the same knowledge, but some other physical laws upset these relations in a seemingly paradoxical manner, and this is why some of our navigators have been puzzled during the last trying season upon the North Atlantic. When the Arctic current sweeps down upon the waters of the Gulf Stream sufficiently to slightly chill them, even though the southern flood still remain warmer than the invader from the north, the flow of the Gulf Stream dips below the Arctic waters, because its load of salt and the lowering of the temperature only a few degrees alters its relative density and makes it actually heavier than the much colder waters that override it and for a time prevail upon the surface of the ocean.



The Bristol Iceberg Detector Which is an Ingenious Adaptation of the Thermo-Electric Couple.

area of high pressure, and this probably drives the waters forming the Gulf Stream westward and into the confines of the Gulf of Mexico, and thence northward through the channel we know of the southeastern coast of Florida. The trade winds increase this movement. The height of the Gulf Stream's surface above Cape Florida is several feet above the surface of the cur-